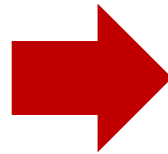


Domestication induces changes in behavior/physiology/morphology



Wolf



Dog

How did it happen?

Domesticate /tame foxes



Silver fox

Dmitry Belyaev's domestication experiment (1959-)



Select *tamability*

If you wished to breed a strain of fox that was tame, one way to do it would be to pick the **darkest** pups in the litter as the stock for breeding the next generation.



Belyaev's selective breeding program



50 years (35-40 generations)
→ 50,000 foxes

What have changed in the foxes over many years of selective breeding?

1. Floppy ears, curled tails
2. Patches of white fur
3. Lost musky fox smell
4. Barking, wagging tails, licking humans
5. Reduce fear response (corticosteroid)

Take-home message #1

Behavioral traits (personality)
are closely associated with
other morphological or
physiological traits.

Take-home message #2

Domestication can induce many changes in animals.

But not seen in nature?

Why?

Animal and human intelligence

What makes us unique?

Humans are more
intelligent.....

Human “species-specific” traits...

But some animals might have evolved simpler forms...

Some animals can manage...
logic, thought, reasoning,
planning, self-awareness.
They have empathy,
mourning, ritual....

The evolution of human intelligence

Ultimate causes?

Proximate causes?

Ultimate causes

1. Social brain hypothesis
2. Sexual selection hypothesis
3. Social competition hypothesis

1. Social brain hypothesis
2. Sexual selection hypothesis
3. Social competition hypothesis

Intelligence evolved as a means of surviving in large and complex social groups

1. Social brain hypothesis
2. Sexual selection hypothesis
3. Social competition hypothesis

a. **Runaway:** no direct/ indirect benefit



1. Social brain hypothesis
2. Sexual selection hypothesis
3. Social competition hypothesis

b. Good gene: against pathogens/
parasites



1. Social brain hypothesis
2. Sexual selection hypothesis
3. Social competition hypothesis

Human domination over its habitat;
free to deliver more complex social skills

Proximate causes

Evolution of human brains
Evolution of human language

Evolution of human brains

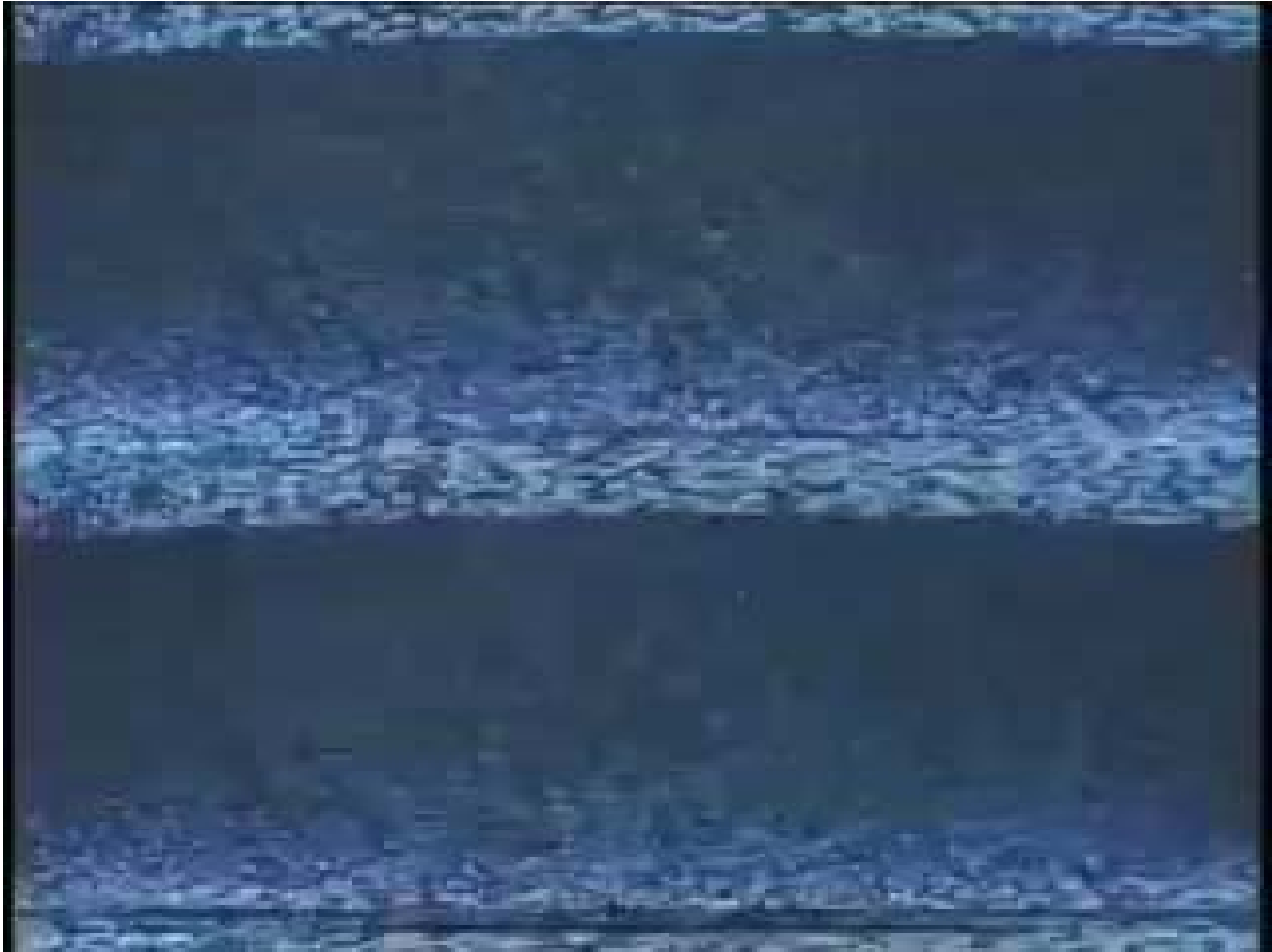
Evolution of human language

Animal Intelligence and the Evolution of the Human Mind

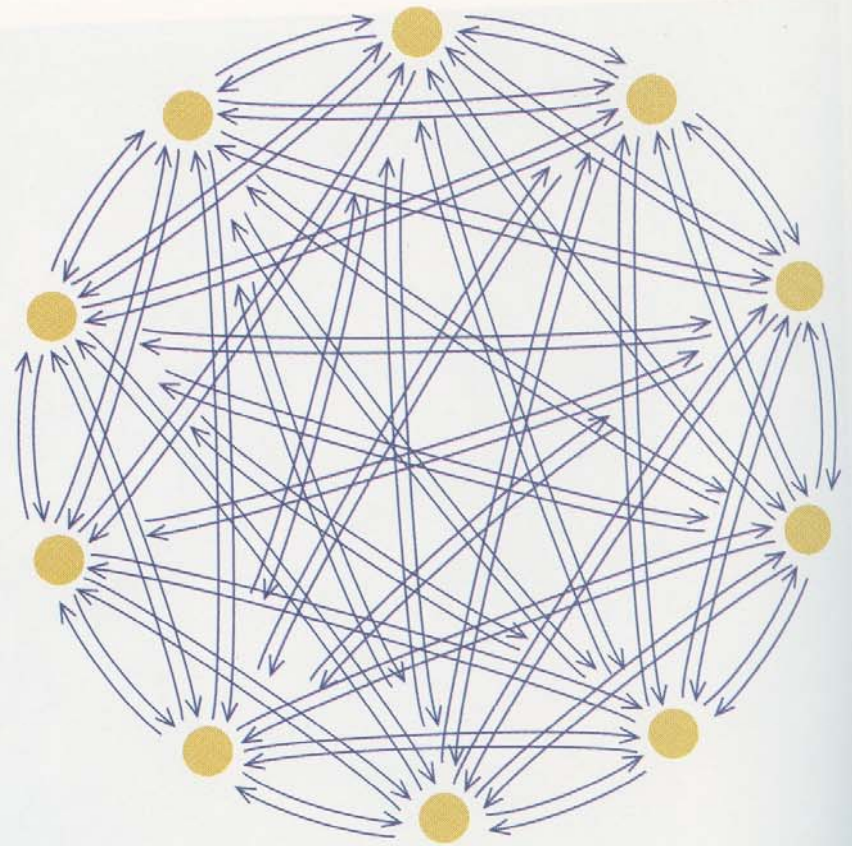
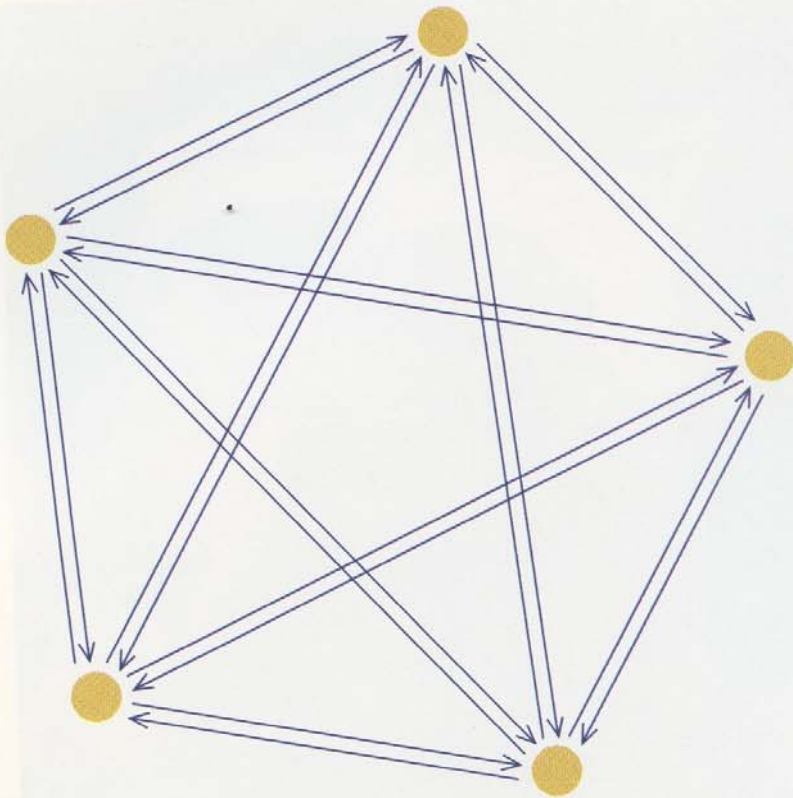
By Ursula Dicke and Gerard Roth (Scientific American, 2008)

1. Human have more neurons in the brain's cerebral cortex
2. The nerves to conduct signals more rapidly

Green Herons

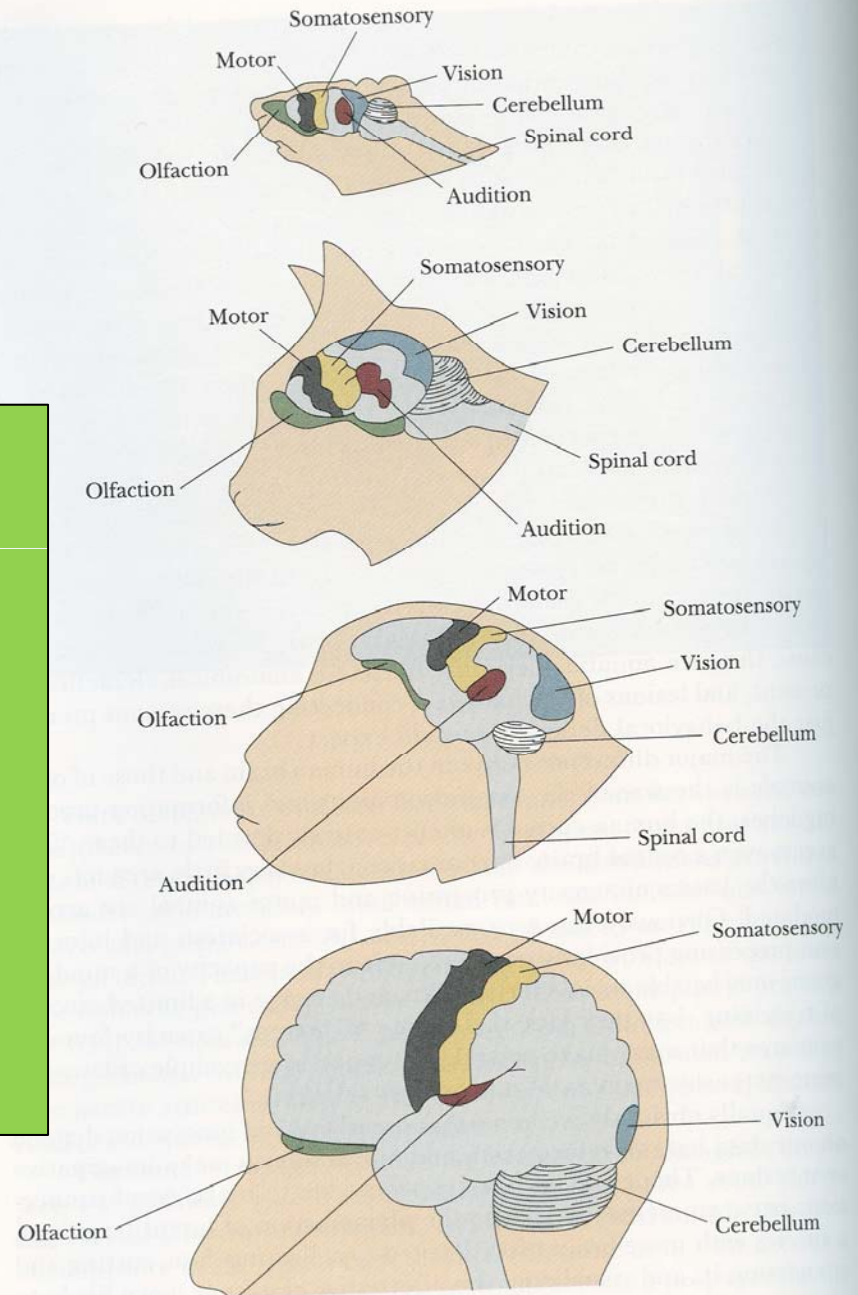


More neurons More networking

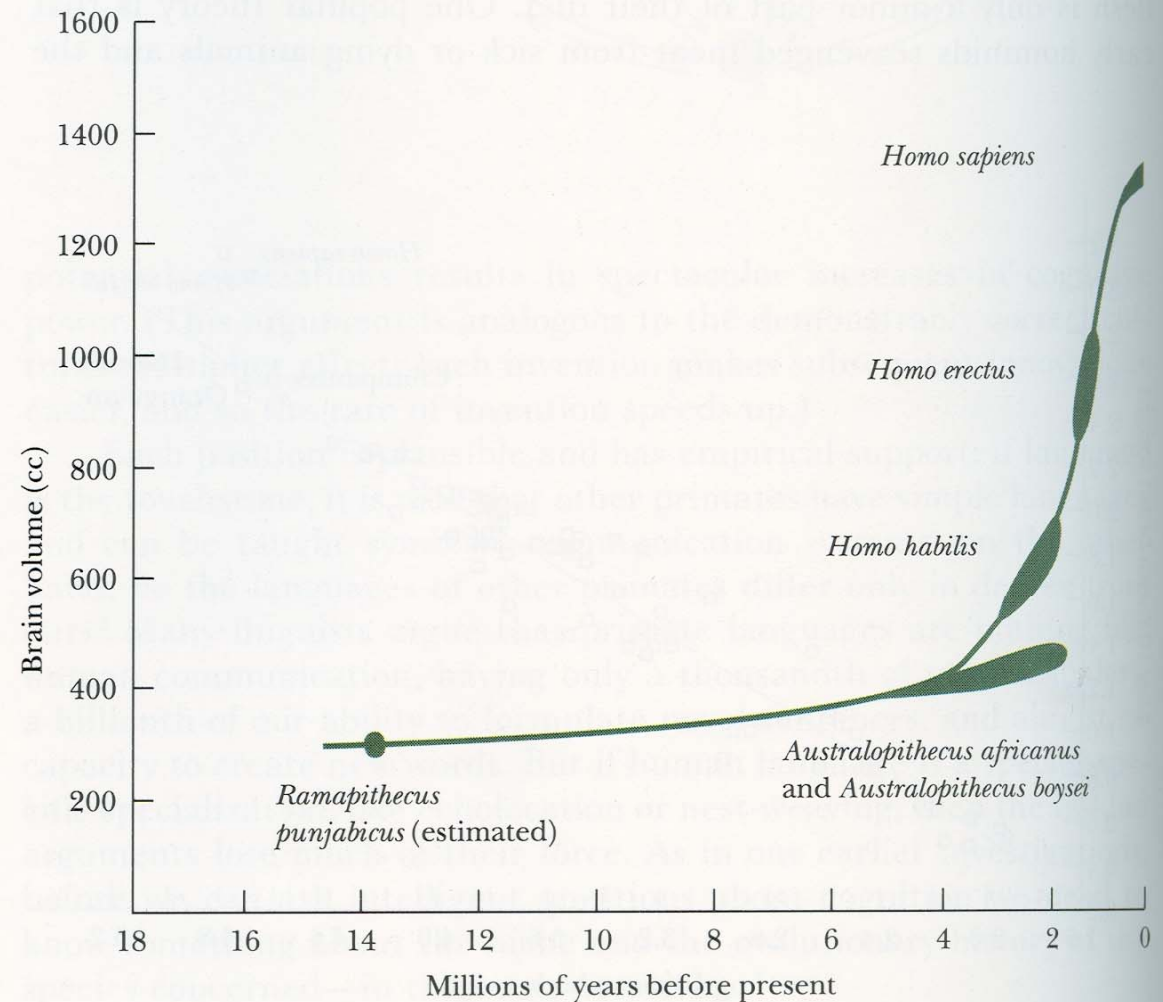


The sensory and motor areas occupy most of the brain of nearly all mammals; much of the remaining part of the cortex is devoted to making associations. Some primates have at least as much association space as sensory and motor regions combined; the highest known proportion of association area is found in humans.

More neurons in cerebral cortex, humans have much more association areas.



Bigger brain volume of *Homo sapiens*



The brain volume of the line leading to humans increased dramatically over the last 4 million years, suggesting strong selection pressure for a large nervous system.

Proximate causes

Evolution of human brains

Evolution of human language

Language is not essential for
cognition.....

Some animals can manage...
logic, thought, reasoning,
planning, self-awareness

but it has a **BIG** effect
on cognitive abilities

Language facilitates the
evolution of human
intelligence

Is spoken language
learned or innate?

Spoken language has
many innate
components

Innate components

Sound generation (consonants; vowels)

Innately recognized consonants

Innately processed vowel

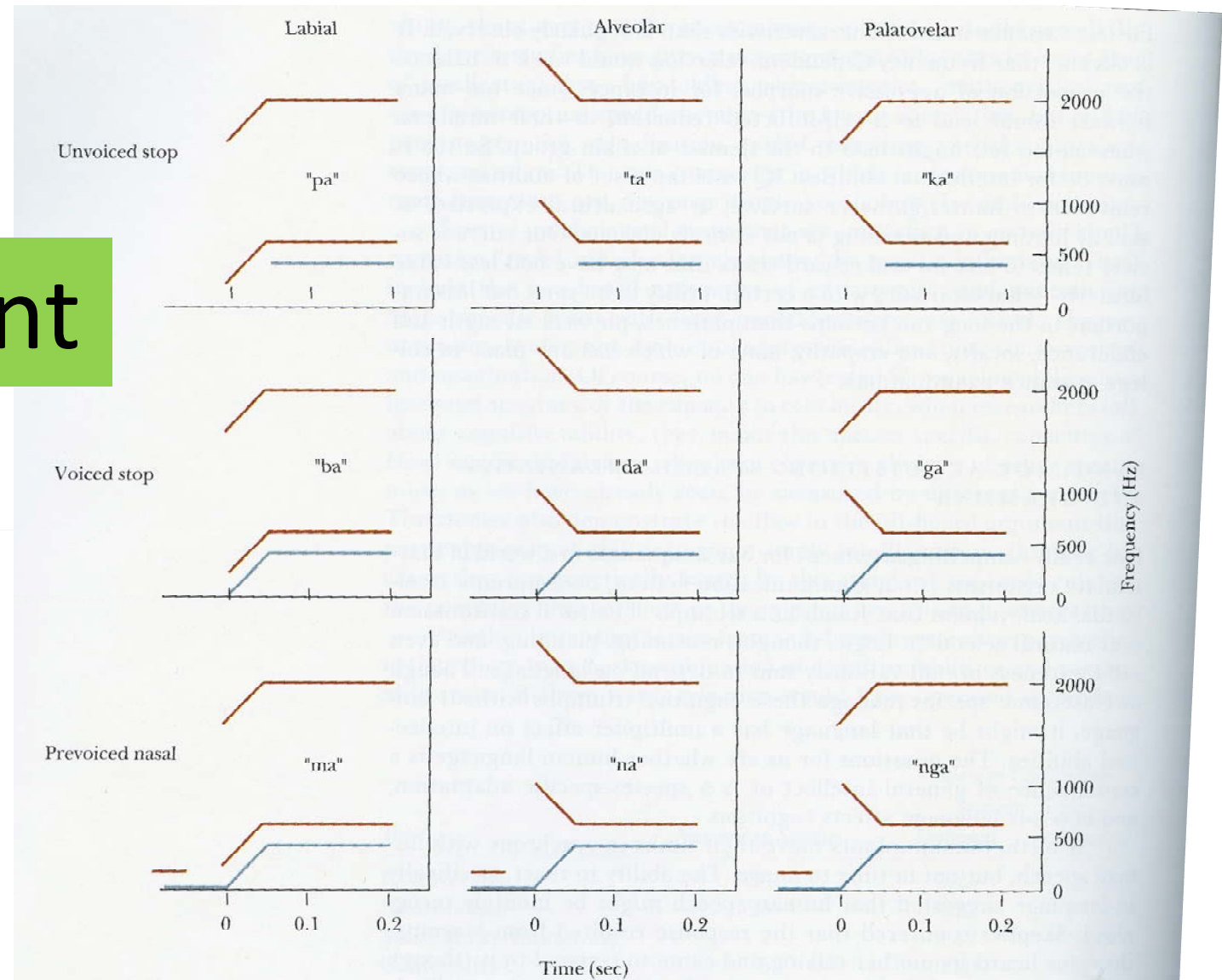
a **vowel** is a speech sound, such as English *ah!* [ɑː] or *oh!* [oʊ], pronounced with an **open** vocal tract vibration.

a **consonant** is a speech sound that is articulated with complete or partial **closure** of the vocal tract.

Syllable (vowel + consonant)

Word (syllables)

consonant



These nine consonants are distinguished by the location in the mouth where the air-flow is manipulated (the labial, alveolar, and palatovelar groups) and the relative timing of the airflow change and the voicing of the vowel in the throat (prevoiced, simultaneous voicing—"voiced"—and delayed voicing—"unvoiced"). The airflow manipulations mainly alter the form of the second and third "formants" (the upper two lines in these sonographs), while the timing of voicing is reflected in the lowest (first) formant, shown in blue.

Innate components

Sound generation (consonants; vowels)

Innately recognized consonants

Innately processed vowel

The basics of Grammar are innate

Universal grammar

Noam Chomsky: If humans growing up under normal conditions; they always develop a language with a specific property (for example, distinguishing nouns from Verbs).

Innate components

Sound generation (consonants; vowels)

Innately recognized consonants

Innately processed vowel

The basics of Grammar are innate

Learning language requires a little effort

Innate components

Sound generation (consonants; vowels)

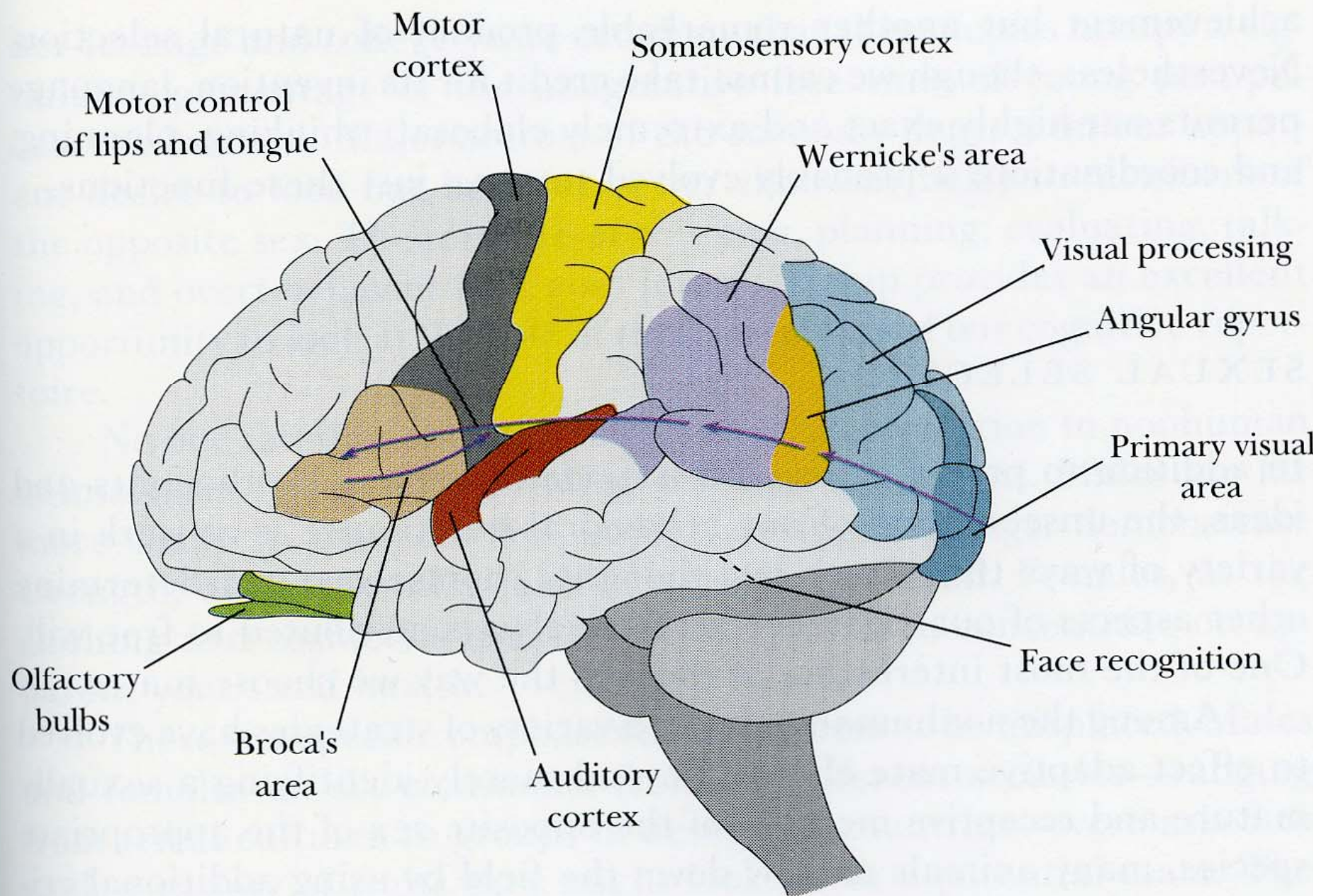
Innately recognized consonants

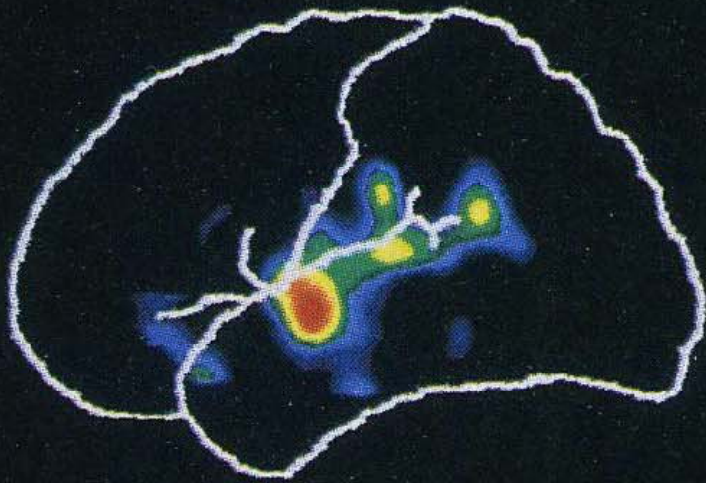
Innately processed vowel

The basics of Grammar are innate

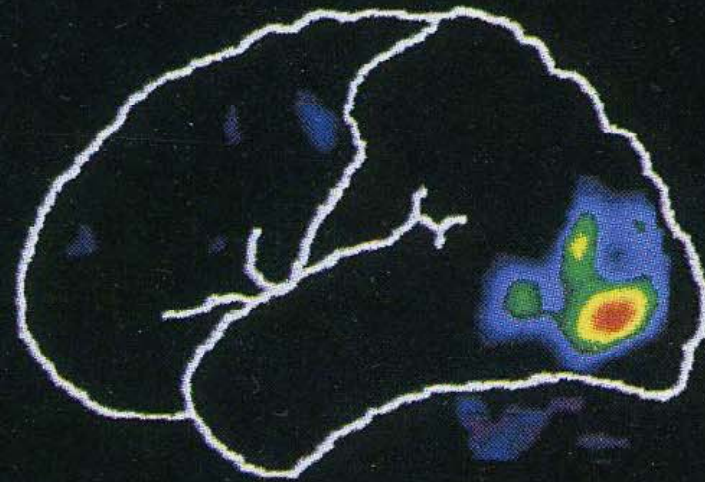
Learning language requires a little effort

Specialized brain areas and genes

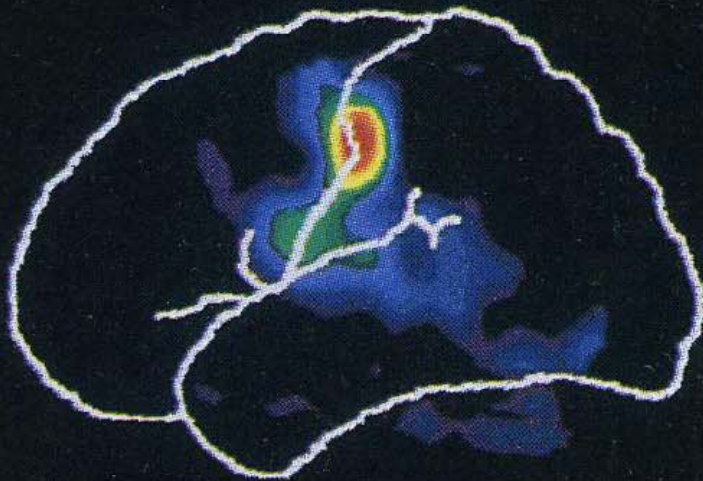




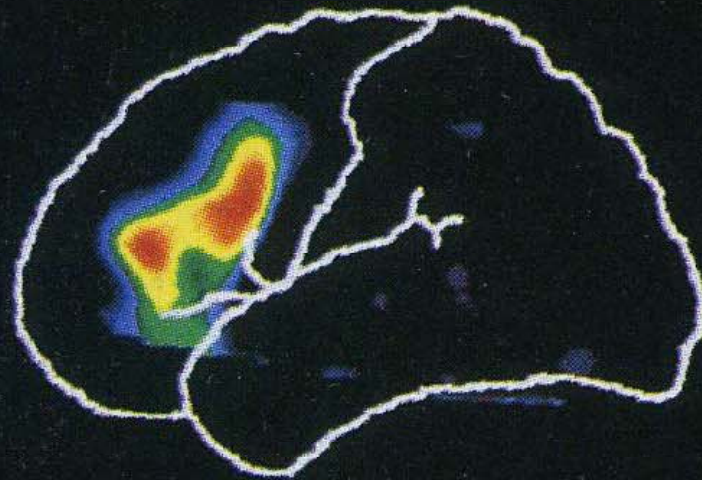
Hearing Words



Seeing Words



Speaking Words



Generating Words



FoxP2 gene and human language, animal vocalizations

Box 3 | Evolution of *FOXP2*

Great interest has centred on the evolution of *FOXP2*, given the abnormal speech and language development observed in members of the KE family who have a mutation in one copy of the gene. A comparison of the nucleotide and amino acid sequences of the *FOXP2* genes of humans, other primates and other placental mammals^{42,43} shows that *FOXP2* is among the most highly conserved 5% of proteins, indicating that it has a fundamental role in mammals. Moreover, different human populations show essentially no variations in amino acid sequence, indicating that the present *FOXP2* sequence is fixed in modern humans.

Although a number of nucleotide changes have accumulated in *FOXP2* since the human and mouse lineages diverged, around 70 million years ago, only three amino acids have changed in the *FOXP2* sequence. Strikingly, two of these three changes (threonine to asparagine at position 303 and asparagine to serine at position 325) are present uniquely in humans, but not in chimpanzees, gorillas or orangutans. Hence, these amino acid substitutions arose and became fixed in the *FOXP2* sequence since the human lineage diverged from the chimpanzee lineage, only 4 to 6 million years ago. This rate of amino acid change is significantly greater than that expected by chance, given this period of evolutionary time^{42,43}. Moreover, the two amino acid changes in the *FOXP2* sequence satisfy all the criteria for a relatively recent selective 'sweep', in which this putatively advantageous genotype spread rapidly in all human populations. Indeed, it has been estimated that the spread was completed within the past 100,000–200,000 years^{42,43}, close to the time that anatomically modern humans appeared.

These findings of the *FOXP2* nucleotide sequence analysis predict that the two 'human-specific' amino acid changes will prove to have a consequence for the function of *FOXP2*. The change at amino acid 325 creates a potential phosphorylation site, which could affect how the protein functions as a transcriptional repressor, although whether the human *FOXP2* sequence is functionally related to the speech and language capability of modern humans remains to be determined.

Summary

Human language as a specific cognitive ability (elements of language are innate)

Permit highly exact, extremely elaborate thinking, planning, coordination

How is language
originated ?

1. Gestural theory: Human language developed from gestures that were used for communication.

Gestural language and vocal language depend on similar neural systems.

Nonhuman primates can use gestures or symbols for primitive communication.

1. Gestural theory: Human language developed from gestures that were used for communication.

Gestural language and vocal language depend on similar neural systems.

Nonhuman primates can use gestures or symbols for primitive communication.

2. Culture-domestication theory:

domestication relaxed selection pressure for stereotypic songs in the songbirds, foxes

our cultural domestication have relaxed selection on many of our primate behavioral traits, allowing old pathways to degenerate and reconfigure.